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20 A SOCIAL ACTION MODEL OF SITUATED INFORMATION SYSTEMS DESIGN

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Abstract

The aim of this paper is to examine the nature of information systems (IS) design as situated in its organizational context. Much of the IS literature takes a fragmented perspective of the nature of IS design, examining methodological issues, social issues, or political issues in isolation from the context of the design initiative. Recent work in situated action and social cognition provides a basis for a more integrated understanding of situated IS design.

Findings from a participant observation study of situated IS design are discussed. These findings form the basis for an integrative, social action model of IS design. Findings from the study demonstrate how innovative IS design activity is situated in its organizational context. It is argued that the form and nature of an organizational design "problem" are inseparable from its context and that design knowledge is distributed among a design team rather than shared intersubjectively. The situated nature of design requires design skills to be learned through simulated design contexts, rather than the communication of abstract models (as in many formal education programs). The situated model rejects the predefined goal structures assumed by decompositional models of design, such as the "water-fall" model. It is suggested that design goal definition must proceed recursively through the processes of design, which require new approaches to the design and development of organizational information systems.

Keywords: Organization, IS development, design, situated action, innovation, integration.

Introduction

The development of organizational information systems generates a large amount of literature, yet the processes of design, which lie at the center of organizational information system (IS) development, are not well understood (Brown and Duguid 1992; Moran and Carroll 1996; Turner 1987). Optimal design, both in terms of organizational system effectiveness and in terms of user job satisfaction, cannot be expected unless designers possess the skills necessary for good design, but if there is little understanding of what design processes are, then design skills cannot be promulgated or managed (Turner 1987).

Design is not viewed here as a distinct stage of information systems development: design processes form the basis for development activities at all stages of an information system's development life cycle. If an information system is conceived of as a set of technological components (a "computer system"), design activity may focus on a reasonably well-defined problem, but when an organizational information system is considered—an interrelated system of human activity which is supported by computer-based technology (Land and Hirschheim 1983)—this activity becomes much more complex, centering on the solution of "wicked" problems (Rittel and Webber 1973) or "messes" (Ackoff 1974). Such problems are associated with interrelated, organizational systems of activity; they cannot be "stated" or "solved" in the sense of definitive solution rules or requirements (Moran and Carroll 1996), they are socially-constructed (Galliers and Swan 1997) and each problem is interrelated with—and thus cannot be defined separately from—multiple, other organizational problems (Rittel and Webber 1973). The study of design activity is irretrievably interrelated with context: design must be viewed as "situated" (Suchman 1987) rather than isolated. Given this perspective, this paper presents a social action model of design, based upon a longitudinal, participant observation study of design in its organizational context.

Existing frameworks for information system analysis and design tend to be either prescriptive process models, based upon little empirical evidence, or high-level factor models. For example, Boehm (1988) compares the traditional system development life cycle (SDLC) model with his proposed spiral model of system development, arguing that the SDLC model ignores risk management and the need for an iterative design process in conditions of uncertainty with respect to the design requirements of the IS. Yet Boehm's spiral model is based upon overcoming selected limitations of the traditional SDLC approach, rather than upon empirical studies of IS design activity. Organizational frameworks that encompass IT, such as the MIT 90s framework (Scott-Morton 1991), while extremely useful at a strategic level, present a very high-level view, which is less helpful in understanding the issues and complexity of IS design activities within their organizational context.

A more helpful model in understanding the context of system design is the framework shown in Figure 1 (Lyytinen 1987). Lyytinen's framework is a combination of process and factor model, a representational technique advocated by Checkland (1981), who proposes the use of such "rich pictures" as an aid to understanding complex problem situations. By combining a process and factor perspective, the reductionism inherent in either representation alone is avoided. Lyytinen's framework raises the issue of subjectivity and of the multiplicity of target object systems possible in the development of organizational information systems. It also indicates the centrality of language

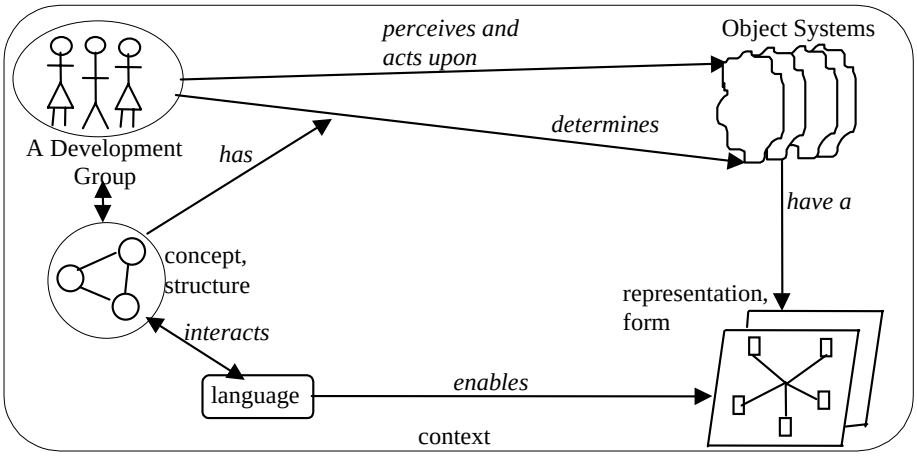

Figure 1. Target Object Systems in the Development Process (Lyytinen 1987)

as the mediator of group interaction. While this model does not (and was not intended to) encompass the detailed activities of design, it provides a very useful starting point in understanding IS development in its organizational context and was used as an exemplar in determining how best such activities could be represented in the social action model of design, which is discussed below.

The Situated Nature of Organizational IS Design

There is evidence in the literature of other disciplines (particularly in the field of social psychology) that a new paradigm of situated action in a social context is emerging. From this perspective; design is seen as a cyclical process of learning about a situation, then planning short-term, *partial* goals (Suchman 1987), which emerge from interaction with the problem context. Design problem and solution representations do not reflect a negotiated consensus, but are emergent and ill-defined. While the situated action perspective originally dealt with individual problem solving, a related area of theory deals with socially-situated cognition. Socially-situated cognition deals with how individuals learn to participate within communities of practice and how their development is shaped by the activities in which they engage. Legitimate participation in a community of social practice arises from adoption of the sociocultural practices of the group—i.e., IS development processes are situated in the sociocultural context of the group and knowledge about how to develop an information system is not necessarily transferable to different situations (Brown and Duguid 1992; Lave and Wenger 1991). Further insight into the operation of design groups is provided by theories of distributed cognition (Hutchins 1990; Norman 1991), which involves the coordinated action of individuals, each of whom holds a partial model of the problem and appropriate action to be taken for its solution. Designers in a study by Flor and Hutchins (1991) were

observed to use external structured representations of the design model as a means of sharing knowledge and coordinating design action.

These theoretical constructs permit the integration of research concerns with respect to IS design. Design from this perspective is **emergent**, as design problem definitions and goal conceptualizations arise or are discarded through the processes of design. The nature of the emerging "problem" is complex and unbounded: aspects of a solution are explored in conjunction with aspects of problem understanding and the designer's understanding of both may change as a result of the process. Ways of representing implicit knowledge may be critical to effective sharing of design models between group members.

The situated action perspective treats knowledge as subjective: if it exists at all, it consists if the ways in which a person interacts with other people and situations. Individual knowledge is therefore based in the context of action and transferable between tasks only when concepts may be generalized from experience gained through previous learning activities. Taking a wider view, to include socially-shared and distributed cognition, a situated design perspective might see knowledge as shared or distributed between individuals and actionable in the context of the sociocultural practices of the group. Transfer of knowledge, therefore, becomes possible only when a new group member is fully conversant with the sociocultural practices or when sociocultural practices can be translated to a new context of social action.

Research Method and Context

The following discussion relates to an interpretive study of the information system design process engaged in by a small, multidomain design team. These analyses are based upon an ethnographic field study of a small design team engaged in information system design, performed through participant observation. The study was carried out over a period of 18 months, from November 1995 to April 1997, with Fujitsu Telecommunications (Europe) Ltd., a medium sized company specializing in the manufacture and installation of telecommunications equipment. Data collection was performed in three stages:

1. Initial interviews were held with project team members.
2. Project design meetings were observed over a period of 18 months: contemporary notes were taken, design representations recorded, documents collected and meetings tape-recorded. Design team members' reflections were recorded at the end of each meeting.

   A soft systems analysis (Checkland 1981) was performed roughly halfway through the study, exploring the objectives and issues of individual team members and the group as a collective, to gain insight into perceptions of target information system objectives and design process objectives.
3. A feedback workshop was held at the end of the study, at which observations on the process of design were presented, giving design team members a chance to validate, comment, and contribute to many of the perspectives covered here.

Research data were analyzed using multiple methods to provide rich insights into the design process and context and to provide a safeguard against limiting the scope of enquiry (Wolfe 1994). Activity mapping, where activities were classified according to

the categories derived by Olson et al. (1991), was used to understand the processes engaged in during design; hermeneutic analysis (Gadamer 1975), employing grounded theory coding and synthesis methods (Glaser and Strauss 1967), was used to analyze the intersubjective meanings and constructions of the design process; and an analysis of the internal, organizational actor network (Latour 1987) was performed to understand contextual influences upon the design "trajectory." SSM modeling techniques (Checkland 1981) and cognitive mapping (Eden et al. 1983) were used to elicit and to analyze interview data, to understand the ways in which designers understood the design (process and product) "problem." Transcripts and observation notes from four design meetings, selected at regular intervals during the design process, were analyzed using discourse analysis, based upon the decompositional approach used by Guindon (1990); this was used to understand the ways in which designers understood and constructed the target object system. Interpretation of the findings was grounded in elements of social cognitive theory to investigate how IS design outputs, models, processes, and work roles are constructed through the situated processes of design activity.

The study commenced as the company engaged in a new information system design project, instigated by the IS manager who assembled a cross-disciplinary team of designers to engage in "business process redesign" and in the high-level specification of the supporting information technology required by the target system. The IS manager was explicitly attempting to work according to the prescriptions of the "strategic IS" literature: aligning IT with business strategy; planning business applications of IT to support work processes; and viewing information system design as a business, social, and organizational problem. The design team involved representatives from all areas of the company in participative design: IS development, marketing, finance, product engineering, operations management, quality assurance, and commercial customer support. The initiative was of particular interest as the subject of research because of the multiple organizational domains from which design team members were drawn, because of the explicit integration of business process investigation with technical system design, and because this type of design approach was new to the company and gave the researcher the opportunity to observe the nature of an innovative design process, rather than existing, normative design procedures.

An Integrated Model of IS Design Activity

The integrated, social action model derived from the study is shown in Figure 2. This model brings together the elements found to influence organizational information systems development and shows the interactions between them.

The model is based on the findings of a single, interpretive study (although the analysis of that study was influenced by the findings of a previous case study and by the researcher's previous career experience as a system designer). Claims for generalizability are based upon the interpretivist argument that "our knowledge of reality, including the domain of human action, is a social construction by human actors and that this applies equally to researchers…there is no objective reality which can be discovered by researchers and replicated by others, in contrast to the assumptions of positivist science." (Walsham 1993, p. 5). Generalizability from this perspective is based upon the

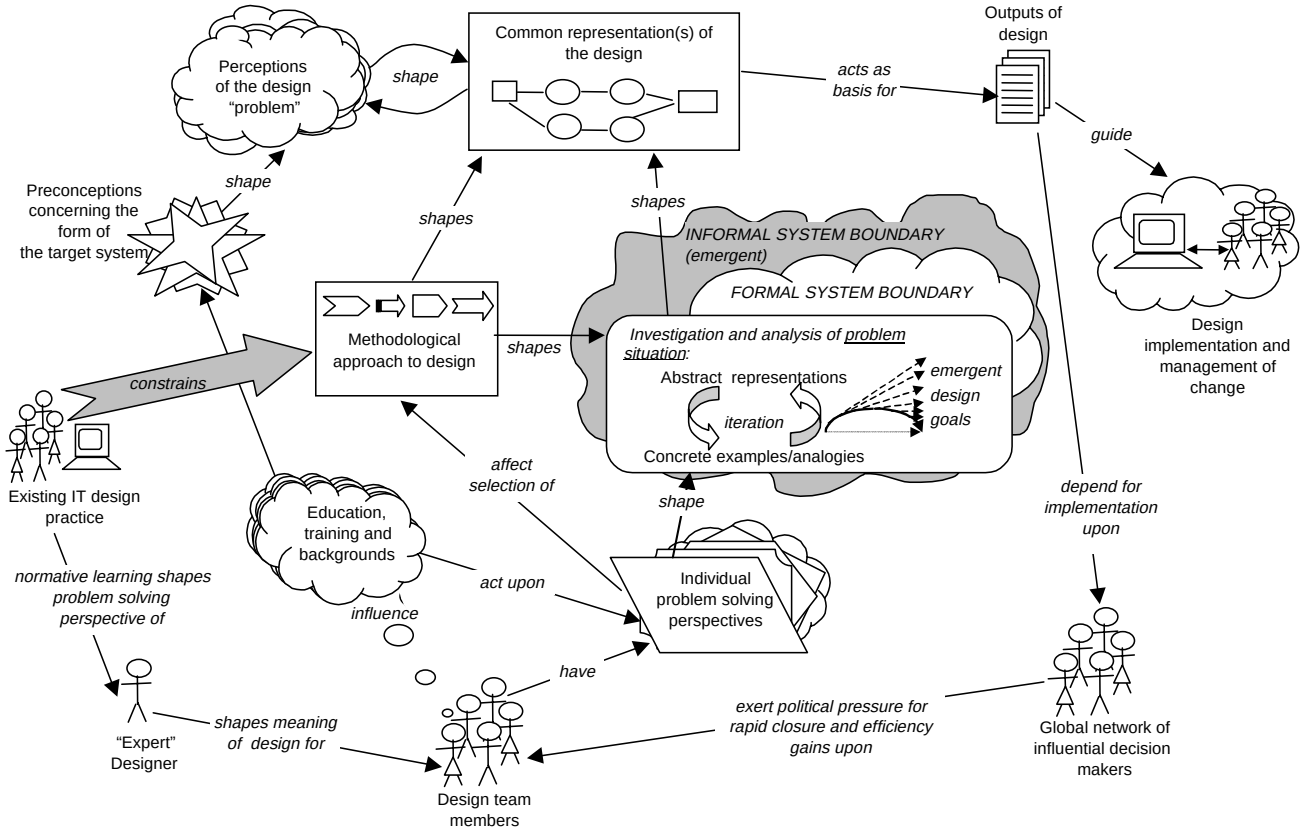

Figure 2. A Social Action Model of the Organizational Information System Design Process

notion that "reality" is an intersubjective, shared human construct, acquired through repeated interactions with the external world. If subjects' perceptions of reality are not shared, the researcher may internalize and represent actors' espoused theories of their work (discursive knowledge), rather than their theories-in-use, or practical knowledge (Argyris and Schön 1978; Giddens 1984). In this case, some degree of generalizability was achieved through sustained interaction with the research subjects over a period of 18 months. Concepts and insights obtained from data in one time period were constantly validated against those from other time periods. Frequent reflections were elicited from the research subjects to validate or invalidate the researcher's perceptions of their experience. Many of the insights discussed below formed the basis for a discussion with the research subjects toward the end of the study and further valuable feedback was obtained.

The social action model will, of course, be validated and enhanced through future studies of IS design. However, it is felt to be worth presenting it as the subject of debate and discussion, as it provides an integrated view of IS design in the context of the organization. The model is discussed under the headings suggested by its various components.

Existing IT Development Practice

The influence of existing IT design practice upon how IS design is approached in organizations is not considered to any great extent in the information system development (ISD) literature. It appears to be assumed that new approaches and formal methods are introduced into a conceptual vacuum and so are adopted and used in the manner intended by their originators. This is particularly true where organizational redesign is considered to be a part of IT-related change, for example in business process reengineering (Davenport 1993). Yet detailed studies of ISD methodology use (e.g., Fitzgerald 1997; Hardy, Thompson, and Edwards 1995) comment on the role played by "experience" in determining how a method is customized for local use, while Nandhakumar and Avison (1997) argue that local development conventions may play a larger role than the formal methodology in determining the design approach.

One would have expected the influence of pre-existing IS development practice to be small in this case, because of the involvement of design participants from multiple organizational domains (i.e., knowledge from no single domain should have dominated the process), especially as the IS manager was concerned with devising new approaches to organizational design by experimenting with team members' suggestions of appropriate design processes and tools. But pre-existing, IT-design practice was found to be constraining in two ways:

(1) it shaped the problem-solving perspectives of the perceived "expert" designer in the team (the IS manager); *and*
(2) it constrained the selection of "available" tools and methods for design (tools and methods of which design team members were aware, which were considered acceptable).

The IS manager's perspective on organizational problem solving was based upon traditional, decompositional approaches to IT design, which were current in the IS department. Thus he attempted to impose a "structured" approach upon the investigation

of complex design problems, ignoring claims by other members of the design team that fundamental issues remained unresolved. This led to the assumption, at an early point in the process, that the design team had a sufficiently in-depth, intersubjective understanding of the design problem for decomposition of a design solution to proceed. Designers later reported that they had wasted a great deal of time and effort in the confusion following this decision, as they had not understood the design problem or the organizational context sufficiently to engage in the highly-structured, specification-based approach to design which ensued. After a few months, the IS manager realized that the design approach required modification and suggested that representatives from some of the work processes with which the designed system interacted should speak with the design team. This approach only partly solved the problem: it was felt that the most effective methods of design were the "Aunt Sally" approach discussed below and observation and feedback from those engaged in the current organizational work processes, following their evaluation of IT system prototypes.

The Role of the Expert Designer

Experimental studies of design suggest that designers construct mental design schemas or frames: knowledge structures that incorporate an understanding of the methods of design and of possible solutions for certain types of problems derived from the designer's background, education and previous experience of the application domain (Jeffries et al. 1981; Rumelhart and Norman 1981). The design framing concept may be useful in explaining why developed information systems so often fail to meet user expectations. Expert system designers appear to apply data-driven rules—the extrapolation of inductive solutions for similar problems—rather than more effective goal-directed behaviors (Guindon 1990).

In this study, it was found that experts in two forms of knowledge—knowledge of design practice and knowledge of the application domain—shaped the meaning of design for other actors. Team members perceptions of certain individuals' expertise permitted those individuals to engage in the "management of meaning" (Smircich and Morgan 1982) for other design team members, to the extent that work roles and activities were defined by these individuals, as well as appropriate forms of design process or product.

The framework given in Figure 3 was developed from the "technical power" framework of Markus and Bjørn-Andersen (1987). This framework was used to analyze design influence in terms of the dominant form of knowledge at different points in the design initiative. The focus of design shifted throughout the course of the initiative and four different types of influence could be identified. Initially, the main focus was very much upon what design approaches were appropriate for the innovative design in which the team was engaged: here the existing expertise of the IS manager in defining organizational IS design *conceptually* was dominant. Following this, the team engaged in *symbolic* debates about the values that should be embodied in the design process, dominated by the views of three individuals who were perceived as having superior "overviews" of organizational strategy. The next (and longest) phase was based in *interpreting* issues of fact concerning the design process for other team members, for example, a lack of progress was explained by the statement "we need clearer objectives

		Basis of influence	
		Issues of fact	*Issues of value*
Scope of influence	*Design goals*	Framing	Conceptual
	Design process	Interpretive	Symbolic

Figure 3. A Framework for the Management of Meaning in Design

for the design." This stage was dominated by the two individuals who had experience with design project management. The final phase was driven by external pressures for closure and was based upon the *framing* of design goals in terms of issues of fact grounded in *current* business processes, dominated by the individual who had most expertise in the application domain.

It is not argued that this sequence of events is universal; this initiative suffered from particular, political pressures for closure because of expectations raised by the IS manager's unrealistic assessment of the "quick wins" that could be obtained through employing a business process design approach to organizational IS definition. It may be that all design initiatives experience these types of influence and that, in different contingencies, different types of expertise may direct the design outcome. Argyris (1987) argues that design models should be periodically complicated to permit organizational learning. By explicitly shifting the *focus* of design to a different quartile of the above model, this may become feasible.

Methodological Approaches to IS Design

The methods chosen to support design activity may shape the manner in which the design is both investigated and represented. Markus and Bjørn-Andersen argue that the choice of a design methodology embodies and propagates the values of IS "professionals," while Star (1992) describes "investment in form" in which, over time, people commit to particular forms of action and structure, so that commitment to the form overrules the demands of particular contingencies. But the extent of the influence imposed by formal ISD "methodologies" (the term used by practitioners) remains debatable. Curtis, Krasner and Iscoe (1988) report how IS developers routinely subvert the processes of structured methodologies, such as design or code walkthroughs, to provide opportunities for "illegitimate" activities, such as dialogues with system users or customer-representatives. Detailed studies of how methodologies are used in practice have concluded that they are not used in full or in the manner intended by their designers, but customized for local use in a manner based upon designers' experiences with the requirements of IS development (e.g., Fitzgerald 1997; Russo, Hightower, and Pearson 1996).

In the studied project, the methods used for design were initially many and varied. Different methods of design problem investigation and representation were employed by different individuals; these methods were clearly based upon their current work domain and training. For example, the marketing representative analyzed the design as a time line, based upon business process deliverables, while the product engineering representative employed a workflow analysis approach, based upon the use of data-flow diagrams. As time progressed, the team adopted more unified methods, generally based upon the methods employed in the development of IT systems within the company: a "structured," decompositional approach, representing business processes using the conventions of software program flowcharts.

This convergence was due to an explicit management decision, driven by the IS manager. Initially, the emphasis had been on opening up the design problem for the new initiative: defining what needed to be done and how. But after a few weeks, the IS manager became dissatisfied with progress, as the design initiative did not fit his experience-based model of how design should proceed, so he imposed what he viewed as the most "obvious" design approach upon other team members. Because of his perceived superior design expertise, this action was accepted by most team members (although not always without demur: the product engineering representative persisted in his use of data-flow diagrams for several weeks). The adoption of a process decomposition approach was found to constrain design perspectives to a large degree: when deriving common representations of the design, the team were unable to conceptualize information and work flows and often redesigned process components many times as a result. The outputs of this structured approach to design were a poor fit with the initial design concept of a flexible, autonomous work system, constraining task autonomy in the target system because of the perceived need to tightly specify process mechanisms to ensure that the very detailed process deliverables were achieved.

Shared Representations of the Design

The importance of external artefacts and representations in clarifying design goals is stressed by empirical studies of design interaction (Flor and Hutchins 1991; Norman 1991; Star 1992). The way in which design information is represented fundamentally affects the way in which knowledge about that design is communicated and conceptualized (Winograd and Flores 1986). Design groups need to maintain intersubjectively held mental models of design goals and processes, if they are to function effectively, yet each group member may only hold a part of the situated knowledge necessary for design to take place (Flor and Hutchins 1991; Suchman 1987). A group of individuals can pool their partial models to perform design activities through the shared meanings attached to artefacts used in common by a group, such as design representations (Star 1989; Norman 1991). Such activity may be viewed as distributed cognition (Hutchins 1990). Hutchins studied how the social organization of distributed cognition affects the cognitive properties of groups. The study examined how communities arrived at shared versus differing understandings. He concluded that cognition in this type of situation is shared among agents in organizationally-prescribed roles and also among the artefacts that they use, such as work procedures, charts, and plans—i.e., that models of how a situation may be handled are embodied in the artefacts used to expedite its handling.

In this study, shared design representations arose from the communication and negotiation of individual perceptions of the design problem and from individual models of the target information system presented to the group. The distributed nature of the design model became evident from the failure of the design team's attempts to achieve joint design (which they referred to as "design by committee"). Even quite late in the initiative, it was clear that the team did not have sufficient levels of intersubjectivity concerning the target system to engage in collective design when faced with a new design problem: this type of task was delegated to an individual who was felt to have sufficient understanding of the emerging problem domain to construct an appropriate design.

Outputs of Design

A critical aspect of the design process was the fixed nature taken on by published representations of the design (producing what Latour [1986] refers to as an "immutable mobile"). Such representations took on a contractual nature, particularly with respect to the initial system boundary definition. As the design progressed and the complexity of the target business processes and their interrelatedness with other processes were understood, the initially-defined system boundary acted as a constraint upon the legitimacy of organizational investigation, even within the design team. Externally to the design team, the initial system definition permitted unsympathetic managers to challenge the scope of the design investigation and to limit access to information. The team thus worked in a "grey area" between the legitimate and emergent system target boundaries—a twilight world of subterfuge and camouflage, where design investigation was disguised as "information clarification" and emergent boundary processes were redefined as "business documentation standards" to legitimize the involvement of actors external to the published system boundary.

Individual Attributes of Design Team Members

Education, Training, and Work Backgrounds

Education, training, and work backgrounds are considered in the work of Rosenbrock (1981), who considers the effects of normative training by Norman (1986), in his work on mental models, and by Beath and Orlikowski (1994), in their work on technical frames. Individuals from different educational backgrounds or different organizational domains may have different perceptions of the purpose, meaning, context, and use of technology: this can affect their ability on agree a common vision of what is required for IS design.

Individuals' education, training, and work backgrounds had two main impacts in this study:

(1) individual problem solving perspectives appeared to be largely influenced by their background, particularly their usual organizational domain of activity;

(2) preconceptions concerning the form of the target system also appeared to be based upon their experience with the organization, which was dependent upon their background and work roles within the organization.

Individual Perspectives of Problem-Solving

Problem solving perspectives shape the way in which individuals explore and conceptualize design problem situations and the way in which they conceptualize appropriate forms for the target information system. For example, the marketing representative on the team initially saw the design process as achieving a radical reconceptualization of business processes, reflecting the strategic focus of his work, while the operations representative, who was more concerned with day-to-day management of the current work process, saw the objective as short-term improvements to operational efficiency. The influence of team members upon each others' perspectives of problem solving was substantial over the life of the design project: perspectives of process objectives converged substantially as the team achieved higher levels of agreement and shared understanding of what they were trying to achieve.

Of particular interest was the problem solving perspective of the IS manager, who as the expert designer of the team initially provided an exemplar for others' models of how the process should proceed. His frame of reference saw design as a structured process, which he defined as being based upon " the traditional problem-solving model of define a problem, analyze it, solve it…identify shortcomings and identify what functions you need in a process." This functional perspective led the IS manager to the conclusion that the design problem could be relatively well-defined through employing a structured, decompositional design approach. Conflicts between this initial assessment of the design problem and the emergent nature of the complex, organizational problem situation became increasingly apparent to him, but he was unable to resolve these, given external pressures for closure created by his initial project time estimates. Toward the end of the project, he was still searching for a structured method with which to control complex organizational design problems, while at the same time acknowledging that his conception of the nature of the design problem had changed and that the process was much more complex than anticipated.

Preconceptions Concerning the Form of the Target System

Preconceptions of appropriate forms of solution shaped the way in which the design "problem" was defined, constraining (in conjunction with available design methods) design models and representations. For example, the marketing representative initially saw the target system objective as improving the effectiveness of organizational customer support functions, while the operations representative saw its objective as resolving operational problems. These perspectives were clearly situated in the context of the individual's organizational interactions and did not change to any great extent over the project lifetime.

The Investigation and Analysis of the System Context

From problem solving in a rational sense, the situated action perspective views design as a cyclical process of learning about a situation, then planning short-term, *partial* goals (Suchman 1987), which emerge from the process of design. Aspects of a solution are explored in conjunction with aspects of a problem understanding; the designer's understanding of both may change as a result of the process. The problem is thus dynamic and constituted of many, interrelated parts. Learning is situated in the context of design: abstract and concrete are false concepts, as abstract representations are meaningless unless they can be made specific to the concept at hand (Lave and Wenger 1991). Studies by Malhotra et al. (1980) and Mayer (1989) demonstrated that representation and solution are interactive processes, i.e., the problem representation is continually reformulated during the process of problem solution. The critical processes of design thus become the exploration, representation, sharing, and *evolution* of partial, emergent design goals and the inductive assessment of when a satisficing solution has been reached. But, in the context of "wicked" organizational problem solving (Rittel and Webber 1973), designers cannot engage in goal-driven behavior, as knowledge of design goals is incomplete. Even the nature of the core design problem requires definition. When *individual* designers do not have appropriate solutions available to them from personal experience, they appear to re-frame the design problem (Malhotra et al. 1980), but little research exists on how design *teams* engage in collective design framing.

In the study, it was discovered that when team members attempted joint design (which would require intersubjective models of design goals and problems), they failed to achieve a satisficing design representation. (This approach was referred to derisively by team members as "design by committee.") But, given a design exemplar, where an individual constructed and presented to the team an initial model of a design component, team members were able to criticize and synthesize the design effectively and confidently. This type of design exemplar was referred to as an "Aunt Sally": a term used for a fairground doll, set up to be knocked over with wooden balls or sticks. This finding illuminates the way in which design knowledge was distributed across the team: knowledge appeared to be "stretched over" (Lave 1988) the team rather than divided between team members.

Additionally, the team was unable to work within the IS manager's dictum that organizational issues be excluded from discussions (based upon the model of business process reengineering upon which he had intended to base the initiative). Instead, constant references were made to organization of the target processes, as designers attempted to clarify abstract concepts through the use of exemplars and analogies based upon their existing experience of such processes. New design goals emerged from these abstraction/concretization cycles, which formed the basis for redefinition of target system components.

The Global Network of Influential Decision Makers

Successful innovation is a political process, where mechanisms have to be created to facilitate and contain bargaining and negotiation between different groups (Mumford and Pettigrew 1975). The design outcome, in terms of acceptance, legitimacy, and the

implementation of change, is dependent upon the global network of influential decision makers to which the design team attaches itself (Law and Callon 1992). The success of a design initiative is dependent upon the "translation" (Latour 1987) of the interests of influential actors in the global network through re-representation of these actors' goals in terms of design interests.

In this study, it was found that the global network of influential decision makers influenced the nature of the design process and its goals to a high degree. The main influential actors in the global network in this case were the board of directors, whose sponsorship was obtained by the promise of "quick wins" (based upon the initial expectation that the design could be effected using a rapid, decompositional approach). As design goals emerged from the process, the majority of these were qualitative in nature, focusing on organizational effectiveness. But the need to present design outcomes as quick wins constantly led the design team to attempt to couch target system effectiveness goals in terms of efficiency gains. This led to a fundamental conflict in the design: between the need for closure engendered by the expectation of rapid efficiency gains and the need for contextual investigation and synthesis required to achieve increased organizational effectiveness. At design reporting points, the team engaged in strenuous efforts to repackage their achievements in terms of efficiency measures: it did not occur to them to report to the board in terms of qualitative measures. At each reporting point, the explicitly discussed reporting objective appeared to be to convince the board that sufficient progress had been made, in terms of expected efficiency improvements, for the design initiative to be permitted to continue, so that organizational effectiveness could be investigated further.

Design Implementation and the Management of Change

The management of change was clearly influenced by the problem solving perspective of the IS manager (the "expert" designer) and was grounded in the decompositional model applied to the development of IT systems. While the detailed nature of change management was not investigated by this research study (which terminated at the end of the IS design process), initial organizational change proved much more problematic than the IS manager (within his frame of reference of design as a "structured" process) had expected. He commented that "the world never changes and people never get any more flexible. You can tell them 'you will do it this improved way' and all they do is argue." The outputs of the design process embodied this perspective: they were provided in the form of written process and information storage specifications; change management appeared to be defined as the design of training sessions for those involved in the new work processes. The sponsorship and support of the global network of influential decision makers was constantly sought during the design initiative, to the extent that successful change eventually depended upon an imposition of the new information system on workers involved in the target system by the board of directors. To achieve this, the outputs of the design were constantly rewritten to support higher work throughput and greater process control. The interests of the global network were thus translated by the outputs of the design process, but the original design intention of a flexible, autonomous system of work activity was sacrificed to a high degree as a result.

Discussion

Social constructivist theory has highlighted the role played by technological exemplars in determining the form of new technologies (Mackenzie and Wajcman 1985), yet little attention is paid to how *process* exemplars may determine the form of innovative organizational processes: this issue may prove significant in the study of organizational innovation. The lack of awareness of alternative tools and methods for design is well documented (Bansler and Bødker 1993; Fitzgerald 1996), yet most authors consider this the result of a lack of designer awareness, rather than a natural consequence of the situated nature of design activity. It is not rational for people to engage in a search for new approaches to design in an organizational context where there are, apparently, proven methods in existence. But the absence of alternatives reinforces "single-loop learning" in organizations (Argyris and Schön 1978). Star (1992) describes how "investment in form" leads to the persistence of a structural web of activity and organizational structure, which may be very difficult to change as it is rooted in practice and historical, local contingency. This study has demonstrated the mechanisms through which such investment in form is propagated.

The role of the expert designer in facilitating effective design has been highlighted by Curtis, Krasner and Iscoe, but little work has been done into the specific mechanisms by which existing structures of action persist in the face of emergent organizational knowledge or how the dominance of certain forms of expertise may be shifted. It is argued here that designers' perspectives of design *process* objectives may converge over time and that the influence of the "expert" designer may decline as other forms of knowledge dominate the process.

Not only is the design problem unclear at the start of the process, but it appears to be counter-productive for the design solution to be defined too early in the process, before the design team has investigated the organizational context fully (this diverges from the traditional model of IS design, where the problem situation is structured through defining solution goals). The situated action school of thought considers *complication* of individuals' problem models an aim, rather than complexity reduction (Argyris 1987; Boland, Tenkasi and Te'eni 1994). It is suggested that, by periodically shifting the focus of design activity, it may be possible to complicate design perspectives and thus concentrate equally upon organizational effectiveness, through the exploration of alternative meanings in design objectives and process. A framework providing alternative foci for such shifts was presented in Figure 3.

The reification of an expert designer's interests through design specification documents, representational mechanisms, and the form of the outputs of the design may remain immutable even after the expert designer's perspective has evolved with the team "vision." Published design specifications raise the expectation of rapid design closure in influential stakeholders, leading designers to continually define design outputs in terms of efficiency gains, in order to "translate" (Latour 1987) influential stakeholders' interests and so maintain external support for the design initiative. Such translation adversely affects the interests of organizational effectiveness. The meaning of the design initiative for influential decision makers within the organization needs to be managed by the expectation of evolving design goals, system boundaries, and specifications, to preclude design legitimacy constraints.

Implications of the Social Action Model of IS Design

From the perspective of education, a major implication of this model is how the skills involved in organizational information system design are taught and/or acquired. Lave discusses how individuals are unable to abstract maths skills which they are able to apply in specific contexts, such as the supermarket or weight-watchers groups, to a classroom environment: this example is instructive if we are to teach design skills. This paper has argued that design skills are situated in the context of organizational problem investigation and that a design "problem" is dynamic and constituted of many, interrelated parts which are viewed in different ways by different design team members. Requirements for a design solution are explored in conjunction with conceptualizations of the design problem: designers' understandings of both evolve as a result of the process. When the situated nature of design is excluded from consideration in order to derive a prescriptive process model, we are left with ISD "methodologies," which this paper has argued to be largely irrelevant to the processes of situated IS design. Yet IS managers continue to search for prescriptive methods by which design may be controlled. Two implications arise:

1. As design knowledge is situated in problem investigation and solution synthesis, design skills may only be acquired through situated practice—that is "learning through doing." Classroom teaching of design should therefore provide simulations of design environments, to supplement abstract discussions of conceptual models.
2. Educators might manage the expectations of future IS managers by exposing the situated nature of innovative design activity, to make explicit the failings of prescriptive methods.

It is proposed by this paper that the fairly simplistic models of design activity presented in most literature accounts of design could be replaced by a situated, social action model of design such as that shown in Figure 2. This model encompasses the research findings of a single study of organizational IS design and, therefore, requires further validation and investigation. Traditionally, educators have concentrated upon prescriptive models of analytical design to reify IS design processes. This paper reveals design as situated, social interaction with the local environment within a design "community" based upon a common vision of short term goals; learning-through-doing is viewed as more important in communicating this concept of design than is memorizing prescriptive process models.

The core challenge in organizational information system design appears to be the management of conflicting demands: balancing external (to the design project) pressures for product delivery against internal requirements to investigate and explore the implications of emergent target system goals and boundaries. Design may be viewed as a cyclical process of learning about a situation, then planning short-term, partial goals which emerge from the process of design. But the emergent and distributed nature of high-level design goals and scope affects the perceived legitimacy of design problem investigation. Design team exploration and prescriptions for action within the "grey area" between the formal (published) and informal (emergent) target system goals and boundaries may not be perceived as legitimate by external stakeholders and organizational managers *or by design team members*. A critical management activity for organizational IS design might therefore be seen as periodic review of the design scope—design goals and target system boundaries—with the recognition that goals and

boundaries are subject to change and such change needs to be managed both externally to and internally within a design team.

The way in which the meaning of design is shaped by the influence of "experts" in design practice or in an application domain has implications for the selection of design team members: managers could consider the selection of design team members with expertise in a variety of design approaches and relevant organizational domains to preclude the dominance of a single perspective. The paper discussed how differing forms of pre-existing knowledge dominated design negotiations at various points in the design process: it would seem that an effective design might best be achieved by managing the process so that it repeats or varies the cycle of influence observed in this study. Such a variation might be achieved by periodically reviewing and questioning the goals or processes of the design project.

Finally, it is argued that the definition of problem goals and objectives may be problematic if the process objectives of design team members are not coherent. It was observed that sociocultural cohesion, indicated by high levels of group convergence regarding *process* objectives (what the design process should achieve and how) was more achievable than group convergence regarding the *product* of design (what the target information system should do and how). A "common vision" of process objectives, resolving the question of what constitutes cultural knowledge and how such knowledge is communicated and learned, is more important to successful design than a common vision of design goals.

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